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November 20, 2019

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: Notice of *Ex Parte* Presentation, IB Docket No. 11-109; IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, and SAT-MOD-20151231-00091, SAT-AMD-20180531-00044, SAT-AMD-20180531-00045, SES-AMD-20180531-00856

Dear Ms. Dortch:

On November 18, 2019, Valerie Green, executive vice president and general counsel of Ligado Networks, and the undersigned met separately with Will Adams, legal advisor to Commissioner Carr; and Umair Javed, legal advisor to Commissioner Rosenworcel. We reviewed the attached documents and discussed how the record and the review process of the Modification Applications are complete and thus this item is ready for Commission action. We also discussed how this 40 megahertz of lower mid-band spectrum can advance the transition to 5G. Finally, we stressed that after nearly four years the Commission should end the unreasonable delay that has marked this proceeding and schedule a vote on an order approving the Applications.

Please direct any questions to the undersigned.

Sincerely,

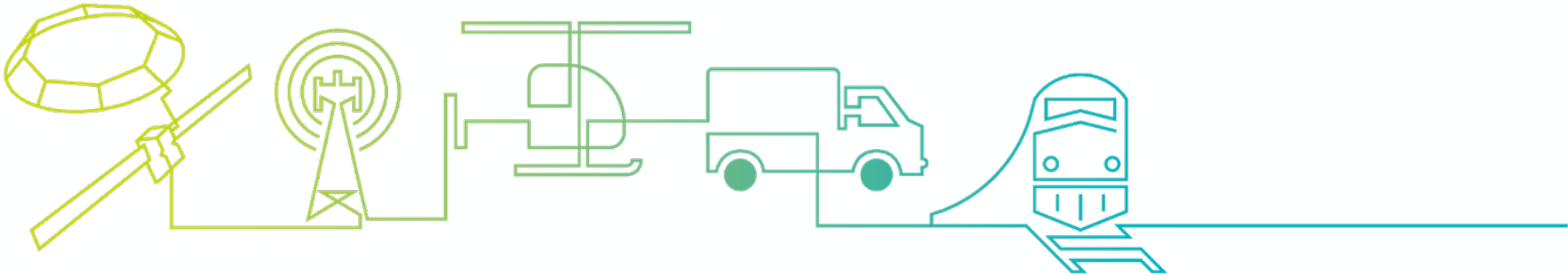
_____/s/_____
Gerard J. Waldron

cc: Mr. Will Adams
Mr. Umair Javed

Attachments

Ligado Networks Role in the 5G Future

NOVEMBER 2019



ligado NETWORKS | Making Stronger Connections

Ligado Networks Opportunity Overview

Ligado Is A Unique Opportunity to Deliver Lower Mid-Band Spectrum Now

Advances the critical need for mid-band spectrum to accelerate new 5G deployments

FCC Action on Ligado's Proposals Represents 40 MHz of Greenfield Spectrum

20 MHz uplink, 10 MHz downlink and two 5 MHz channels for flexible uplink or downlink

Ligado Spectrum Has Significant Near-Term Utility in Both 4G / 5G Networks

Flexible implementation path for increased 4G capacity and overall 5G performance

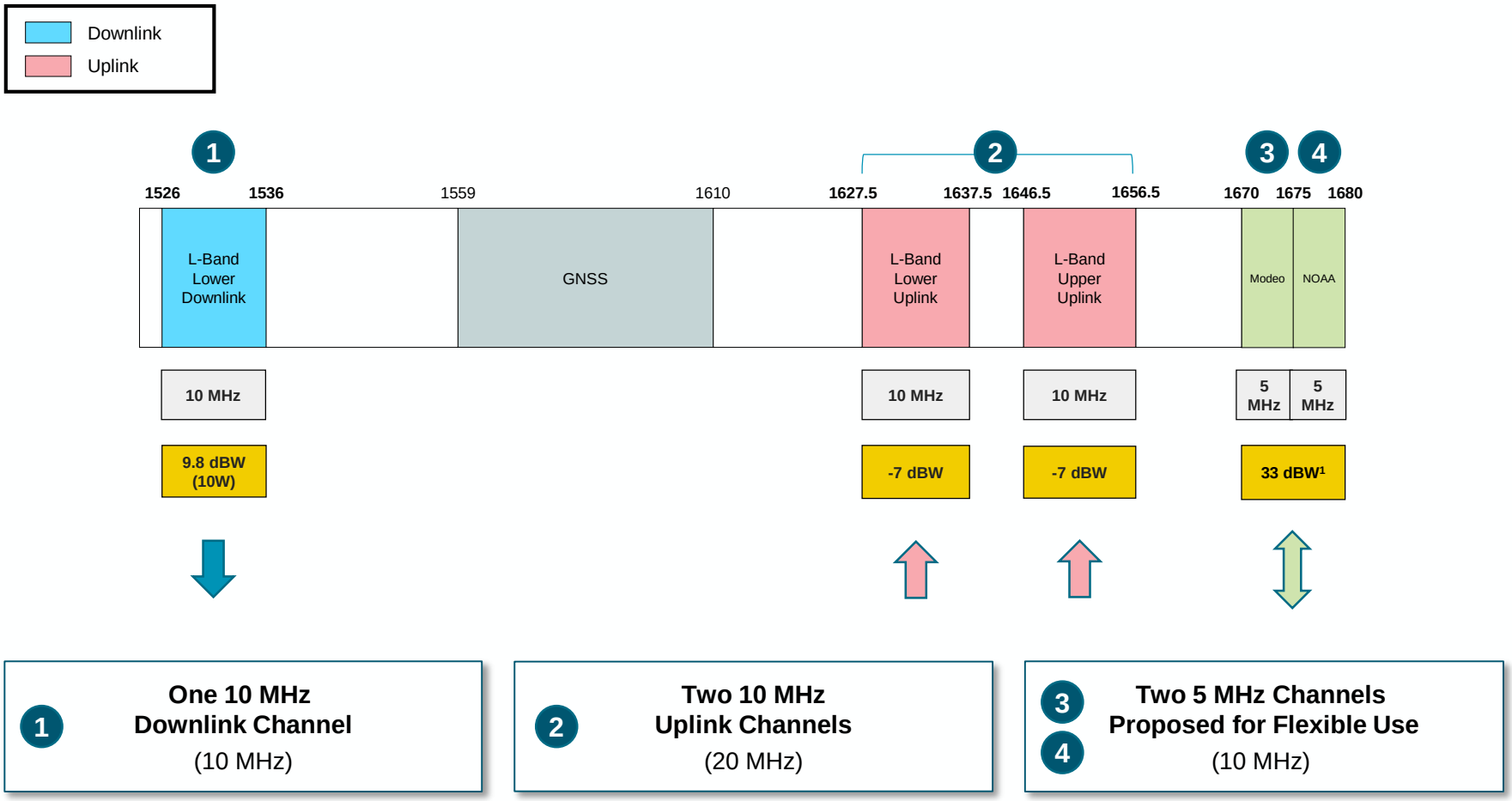
Ericsson and Nokia Technical Studies Validate Ligado Spectrum for 4G / 5G

Greenfield Lower Mid-Band Spectrum = Increased Coverage + More Capacity + Lower Latency + Better Mobility at Lower Cost and Faster Deployment

U.S. Leadership in 5G is Essential for a Secure and Sound Wireless Supply Chain

Trusted global equipment suppliers benefit the most from early 5G deployments in the U.S.

Four Individual Blocks of Lower Mid-Band Spectrum That Make Up a Highly Flexible 40 MHz



[1] ***1670-1675 MHz:*** *33 dBW peak EIRP nationwide, higher EIRP allowed in 30 CMAs;* ***1675-1680 MHz****: Rules not finalized yet, 33 dBW peak EIRP as per NOAA NPRM*

L-Band is Integral to the Mid-Band Spectrum Solution for 5G Networks

	Mobile Wireless			Fixed Wireless
	Low-Band (< 1 GHz)	**Lower Mid-Band** (1 – 2 GHz)	**Higher Mid-Band** (2 – 6 GHz)	**High-Band** (Above 6 GHz & mmWave)
Description	Used for nationwide coverage; inter-site interference challenges	Supports versatile deployment for coverage and capacity	Deployed for localized capacity; in-building and propagation issues	Supports select outdoor / indoor applications; no broad-based mobility
Macro	●	●	◑	○
Micro	●	●	●	○
Small / Indoor	○	●	●	●
Broad-Based Mobility	●	●	◑	○
In-Building Penetration	Effective	Effective	Limited	None

Lower Mid-Band

- Work-horse spectrum due to flexibility in providing coverage and capacity
- Significantly better propagation characteristics than higher mid-band
- Ideal overlay onto existing 1-2 GHz networks grids

Higher Mid-Band

- Offers wide channels that facilitate higher data speeds / bandwidth for targeted capacity in 5G
- Propagation and in-building penetration limitations restrict its broad-based deployment on existing 1-2 GHz network grids

Ligado's Lower Mid-Band Spectrum is Among the Key Bands in the Near-Term U.S. Pipeline

Nokia and Ericsson Technical Evaluation of the Ligado Spectrum

Nokia evaluation of capacity benefits of Ligado spectrum

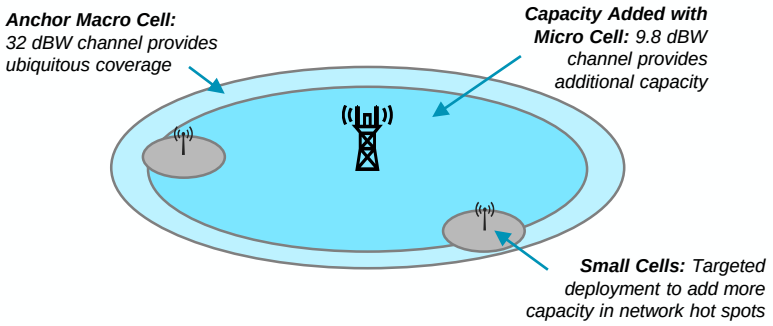
Existing 4G Networks

Adds Immediate 4G Capacity

Greenfield, lower mid-band spectrum

Rapid deployment on existing infrastructure
1.5 / 1.6 GHz fits neatly on existing mid-band, cellular grids

At very low cost
Adds capacity without incremental site build out



Ericsson and Nokia evaluation of Ligado + higher mid-band

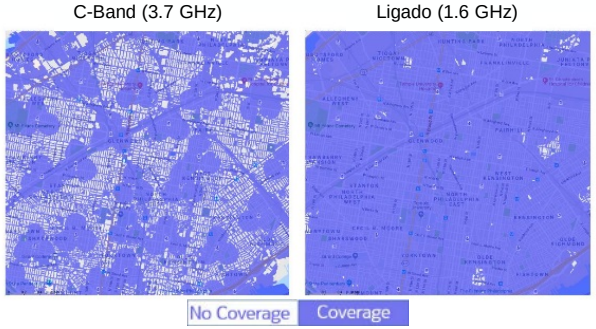
New 5G Rollouts

Boosts Overall 5G Performance

Ligado spectrum enhances other bands (e.g. other mid band and high band spectrum)

Expands 5G coverage
A 5G cell site utilizing Ligado uplink band can cover an area at least 4.8 times greater than C-band

Boosts capacity and reduces latency
Delivered thru greenfield "always-on" channels



Ligado offers wireless carriers greenfield spectrum that can be flexibly deployed across 4G and 5G networks to address their most pressing network demands

Supply Chain Integrity Is Essential to U.S. 5G Leadership and Security

- An “all of the above” spectrum policy will enable U.S. carriers to accelerate broad-based network deployments and make the U.S. an early global leader in 5G
- Early 5G equipment orders from U.S. carriers will confer first mover advantage for trusted global infrastructure vendors giving them a scaled cost curve and technical leadership
- It is in the U.S. national interest to maintain supply chain integrity which can only be assured if the U.S market takes the lead in 5G deployments using trusted infrastructure vendors

Spectrum is not only the lifeblood of the wireless industry but also influences 5G supply chain integrity, economic growth and national security

LIGADO'S LICENSE MODIFICATION APPLICATIONS ARE RIPE FOR APPROVAL

Nearly four years ago, Ligado submitted License Modification Applications ("Modification Applications") to the Commission seeking authority to deploy satellite-terrestrial operations that could help the Nation transition to 5G. By approving the Modification Applications, the Commission can advance the pressing goal of advancing 5G while also protecting GPS. It is widely recognized that mid-band spectrum is essential to a rapid roll-out of 5G, and approval of the Modification Applications will unleash 40 megahertz of lower mid-band spectrum that can be put to use *immediately*—without any relocations or transitions—to hasten the 5G transition. Moreover, Nokia and Ericsson have studied the band and concluded that this 40 megahertz of lower mid-band spectrum can enhance the use of other bands, including other mid-band spectrum like the C-band and high band spectrum, for 5G.

In issuing the Public Notice on the Modification Applications in April 2016, the Commission asked for "specific relevant technical information" about how the Modification Applications could affect GPS. Ligado answered that call with two studies that establish GPS devices will not experience harmful interference, which of course is the standard established by the Commission's rules and practice. In addition to these concerns Ligado also has answered questions raised by Iridium and some in the aviation community. Finally, to address any distinct concerns from Government users, Ligado proposed a condition to repair or replace any impacted Government devices. The combined record thus establishes that the Commission can approve the Modification Applications because they will protect GPS devices and also advance our nation's transition to 5G; it is in the public interest.

Record Shows Ligado's Spectrum Plan Can Co-exist with GPS Devices. The record reflects the co-existence agreements with the five major GPS device manufacturers, Ligado's adoption of the power level recommended in the DOT Report, and the thousands of hours of testing ─ all of which confirm and ensure that Ligado's proposed terrestrial operations will not cause harmful interference to commercial GPS devices.

- *Creation of a new Guardband for GPS.* The Modification Applications reflect the GPS manufacturers' request in the 2015 co-existence agreements that Ligado relinquish terrestrial rights to 10 megahertz (the Upper Downlink).

- *Power and OOBE Limits Reflect Agreements with GPS Companies.* The power and OOBE limits in the Modification Applications for both Uplink Bands reflect the power limits that the leading GPS manufacturers requested in co-existence agreements reached with Ligado in 2015.

- *Power Limits for Lower Downlink Reflect the DOT Report and Protect the Most Restrictive Use Case.* The power limit for the Lower Downlink was determined by the FAA and the DOT. After extensive analysis that Ligado undertook with the FAA and other aviation stakeholders, Ligado amended its Modification Applications in May 2018 to provide further protections for certified aviation GPS devices—specifically, a power limit of 9.8 dBW or 10 W, which is the recommendation from the DOT Report to protect

certified aviation GPS receivers. This level is a 99.3% reduction from the limits which were acceptable to the GPS manufacturers in the 2015 co-existence agreements.

- *Extensive Engineering Tests Confirm Effectiveness of Power Limits.* Three exhaustive engineering studies, involving over 5,000 hours of lab tests, have analyzed the spectrum plan: one by Roberson and Associates, one by NASCTN, which is sponsored jointly by the Department of Commerce and Department of Defense, and one by DOT, which is reflected in the DOT Report. All three test results establish that: (i) the overwhelming percentage of GPS devices (*i.e.*, smartphones) have been robust for many years and experienced no impact whatsoever, (ii) the conclusion of the GPS companies to agree to these operating parameters is obvious since their devices can co-exist with the spectrum plan, (iii) devices in every category of the GPS ecosystem would not experience any harmful interference if Ligado were permitted to deploy a terrestrial network in accordance with the proposed parameters, (iv) the small number of high precision devices that may be affected can be readily and affordably upgraded, and (v) GPS devices are high-functioning equipment that can easily co-exist with the proposed parameters in the Modification Applications.

    - Despite urging by many stakeholders, DOT's test did not analyze whether GPS devices would experience harmful interference, the standard in the Commission's rules. Instead, the DOT test assessed whether GPS devices would experience a 1 dB change in C/N_0. Even using this approach—which is not one the Commission or NTIA has used in similar contexts and is not reflected in the Commission's existing rules—the test results show that in every category, there are devices that would not experience a 1 dB decrease in device-measured C/N_0 under Ligado's proposal.

Government Users Have Additional Protections. The 2018 amendment to the Modification Applications underscores the commitment Ligado has made to providing specific mitigation measures—including, but not limited to, upgrading or replacing any impaired U.S. Government devices—to address concerns about potential impact on U.S. Government devices.

Iridium's Concerns Have Been Shown to Lack Merit. Iridium's assertions that Ligado's proposed terrestrial operations will produce harmful interference to Iridium's satellite devices is unfounded. Analysis produced by a third-party consultant to the DOD, Iridium's largest customer, confirms that Iridium's devices will not experience harmful interference from Ligado's operations in the 1627.5-1637.5 MHz band. Ligado analysis in the record establishes the same point.

Aviation Interests Are Getting an Industry Led Solution. Inmarsat is developing a commercial and technical plan for airships around the world to address any potentially necessary retrofitting for certain SATCOM devices. All aviation stakeholders are involved in the development and approval of this new technology.